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Our letter of November 30, 2001

New claims

- S.H.A.*
1. A method for axially moving a tube (1) in a borehole (2) in the ground (3), wherein the tube (1) is moved simultaneously along and about its axis (A) and wherein a drill (5) is used of which the rate of material removal is independent of the direction or speed of rotation of the tube (1) about its axis (A), and wherein a drive mechanism (6) for the drill (5) is connected to the ground (3) and is rotated jointly with the tube (1) characterised in that the tube (1) is moved about its axis (A) in a series of alternating, angularly opposite, rotating movements within a limited angular range of rotation, the angular range comprising at least one full rotation of 360°.
 - 10 2. A method according to claim 1, characterised in that the limited angular range of rotation is preselected to comprise less than 1800°, preferably less than 1080°, in particular less than 720°.
 3. A method according to claim 1 or 2, characterised in that the time needed to complete two consecutive, alternating angularly opposite rotating movements is at least 10 s, preferably at least 20 s.
 - 15 4. A method according to claim 1 or 2, characterised in that the frequency of alternating angularly opposite rotating movements is such that an oscillation is generated that corresponds to the base or higher order natural frequency of the tube (1).
 - 20 5. A method according to any of claims 1-4, wherein a series of alternating, angularly opposite, rotating movements within the pre-selected angular range of rotation is preceded and/or succeeded by a non-oscillating, continuous rotating movement about its axis (A).
 6. A method according to any of claims 1-5, characterised in that said 25 tube (1) is composed by connecting successive tube parts (4a, 4b) rotationally rigid end-to-end.

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7. A method according to claim 6, characterised in that tube parts (4a,4b) are connected end-to-end by welding.
 8. A method according to claim 6 or 7, characterised in that said tube parts (4a,4b) are connected while axially inserting the tube (1) into the borehole (2).
 9. A method according to any of claims 1-8, characterised in that the tube (1) is axially moved into the borehole (2) in the ground (3) to form a casing for a borehole (2).
 10. A method according to claim 9, wherein the tube (1) is inserted while a borehole (2) is being drilled by a drill (5).
 11. A method according to any of the previous claims, characterised in that the pre-selected angular range of rotation includes less than 360°, preferably less than 180° to remove ground in a circular segment at the tube end, such that, when the tube (1) is axially advanced into the borehole (2), a tip of the tube (1) is advanced along a curved path.
 12. A method according to any of the preceding claims, characterised in that the torque exerted on the tube (1) at the surface (7) is measured while performing angularly symmetrical opposite, rotating movements within the pre-selected angular range to determine a mid-point of lower torque values.
 13. A method according to any one of the preceding claims, characterised in that relative angular orientation of tube sections axially spaced apart is monitored.
 14. A method according to claim 13, characterised in that said monitoring includes observing an axial line provided on the outside of the tube (1).
 15. A method according to claim 13, characterised in that said monitoring includes detecting angular orientations of axially spaced magnetic markings on the outside of the tube (1).
 16. A method according to claim 15, characterised in that said series of alternating, angularly opposite, rotating movements have an azimuth at the

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tube tip, said azimuth at the tube tip being controlled in response to the orientation of the tube (1) in the area of the ground surface (7).

17. A method according to claim 16, characterised in that an alternating torque having an azimuth is exerted to said tube (1), said azimuth at the tube tip being further controlled in response to the orientation of the tube (1) in the area of the ground surface (7) when said azimuth of said torque occurs.

18. A method according to any one of the preceding claims characterised in that pumping of mud is continued while a connection with a next tube section is being made via a hose (14) and packer (16) combination which sealingly connects to the tube section in the hole.

19. A device for axially moving a tube (1) in a borehole (2) in the ground (3), comprising means for moving the tube (1) along and about its axis (A) and connections for connecting the ground (3) to a drive mechanism (6) for a drill (5) carried on a bottom most part of the tube (1) and rotating jointly with the tube (1), characterised in that the means for moving the tube (1) about its axis (A) comprises a rotational drive that is arranged to drive the tube (1) to rotate about its axis (A) in at least one full rotation and that is operatively coupled to control means (30) for controlling the drive to perform alternating, angularly opposite, rotating movements within a limited angular range of rotation, the angular range comprising at least one full rotation of 360°.

20. A device according to claim 19, characterised in that the limited angular range of rotation is preselected to comprise less than 1800°, preferably less than 1080°, in particular less than 720°.

21. A device according to claims 19 or 20, characterised in that the rotational drive and the control means (30) are further configured to selectively control the drive to perform a continuous, non-alternating, rotating movement.

22. A device according to any of claims 19-21, characterised in that it comprises a welding apparatus for welding tube segments end-to-end to form a composed tube, which welding apparatus is arranged to rotate substantially jointly with the tube (1) to be moved in the borehole (2).

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23. A device according to claim 22, characterised in that it is provided with means for surface treatment of the inner and/or outer surface (7) of the tube (1) to be inserted.

24. A device according to claim 22 or 23, characterised in that it is provided with means for aligning and positioning tube ends to be connected.

25. A packer (16) for sealing a tube (1) and arranged to rotate substantially jointly therewith, comprising connecting means for connecting to a fluid or energy supply, characterised in that said connecting means are arranged to fixedly couple the packer (16) to a flexible fluid or energy supply extending from the fluid source.

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Add A1 Abstract

Add C2